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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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VENABLE LLP				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/554,316

Applicant(s)

CARMAN ET AL.

Examiner

DNYANESH KASTURE

Art Unit

3746

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 November 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16, 19, 22, 24-29 and 31-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16, 19, 22, 24-29 and 31-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 November 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Final Drawing Review (PTO-848)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Drawings

1. The previously made objections to the drawings are hereby withdrawn in view of corrected drawings submitted on November 13, 2008.

Claim Rejections - 35 USC § 112

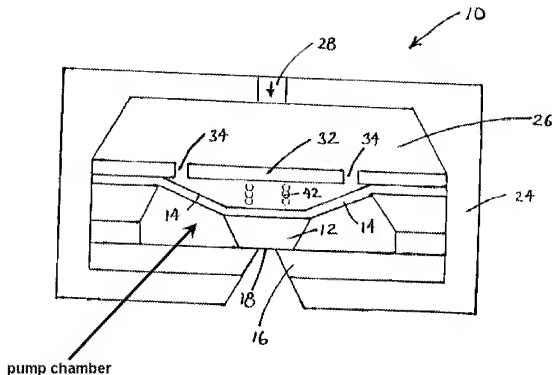
2. The previously made objections to Claims 3, 4, 5, 8, 16 and 22 are hereby withdrawn in view of amendments to the claims submitted on November 13, 2008.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 14 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knebel et al (PG Pub US 20020130284 A1)



5. In Re claims 1 and 14, with reference to Figure 1 depicted above, Knebel et al discloses an actuator mechanism (SMA) comprising:

- an actuator body (10) comprising an actuation chamber (interior space) having a membrane seat surface (16)
- a membrane (SMA) comprising a thin film shape memory alloy (14) that has a martensite-austenite transition temperature (Paragraph [0017]: "...the SMA element is at or below a first characteristic temperature, referred to as the martensite finish temperature (T_{mf}). When heated to a second characteristic temperature, referred to as the austenite start temperature (T_{as}) by electric resistance heating, the SMA element 14 begins a crystalline phase change which is completed when SMA element 14

reaches a third characteristic temperature, referred to as the austenite finish temperature (Taf")

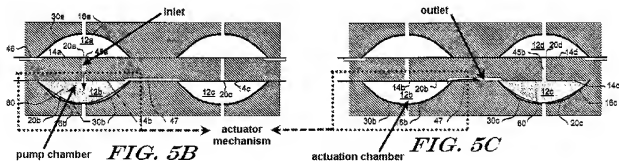
- said membrane being located over said membrane seat surface as depicted to define a pump chamber between said membrane seat surface and said membrane. Note that the inlet (28) has a higher diameter than the orifice (18) therefore the velocity of fluid exiting is higher than at entry since the volumetric rate is maintained for an incompressible fluid (fuel), therefore the fluid is "pumped" to a higher velocity.
- said membrane being movable from an undistorted form to a distorted form as stated in Paragraph [0017]: "During this phase change, the SMA element shrinks in length to assume a generally horizontal flat shape.."
- at least one inlet (28) through which fluid is introduced into the pump chamber
- at least one outlet (18) through which fluid is removed from said pump chamber, said outlet being located at a spaced location from the inlet as depicted
- a bias pressure applicator (as indicated by Paragraph [0018]: "Fuel passing through fuel cavity 26 is FORCED to flow through orifice 34 increasing the velocity of the fuel directed onto SMA element 14"); since the fuel is FORCED to flow through the orifice, it would have to enter the cavity under pressure thereby indicating the presence of a bias pressure applicator; the fuel is therefore a pressurized stream
- with regards to claim limitation "ADAPTED TO pump a pressurized stream of said fluid into said pump chamber at a pressure sufficient to move the membrane from the undistorted form to a distorted form" - MPEP 2111.04 [R-3] states that the clause "adapted to" does not limit the scope of the claim to a particular structure and does not

require steps in a method claim to be performed. With regard to the method claim 14, since the apparatus is a valve in a normally closed position, it would be obvious to a person having ordinary skill in the art to recognize that the fuel can be introduced into the cavity at a pressure that is sufficiently high enough to bias the SMA to its closed distorted position depicted in Figure 1; the bias pressure applicator only has to be capable of applying a high enough pressure ("optional") to distort the membrane

- the fluid introduced into said pump chamber at a temperature that is below said martensite-austenite transition temperature (Paragraph [0018] states: "In this manner, SMA element 14 is cooled more effectively and the response time to return SMA element 14 to its ambient temperature martensite finish phase is reduced", the temperature of the fluid introduced via (28) into the chamber would have to be lower than the transition temperature to cool the SMA)
- a heating system that heats said membrane to an actuation temperature that is above said martensite-austenite transition temperature when said membrane is in said distorted form (Paragraph [0017] states: "When heated to a second characteristic temperature, referred to as the austenite start temperature (T_{as}) by electric resistance heating, the SMA element 14 begins a crystalline phase change which is completed when SMA element 14 reaches a third characteristic temperature, referred to as the austenite finish temperature (T_{af})).

6. In Re claim 25, forced convective cooling is achieved because Knebel et al discloses that fuel is directed to the SMA at increased velocity (thereby increasing heat transfer due to convection) and is therefore cooled more effectively (Paragraph [0018])

7. Alternatively, Claims 1, 14 and Claims 2-11, 15-16, 19, 22, 24, 29, 31-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cabuz et al (PG Pub US 20030068231 A1) and in view of Knebel et al (PG Pub US 20020130284 A1)



8. In Re claims 1, 14 and 32 with reference to Figures 5B and 5C depicted above, Cabuz et al discloses an actuator mechanism (annotated) comprising:

- an actuator body (10) comprising an actuation chamber (annotated) having a membrane seat surface (14b); a thin film shaped membrane (20b) being located over said membrane seat surface to define a pump chamber between said membrane seat surface and said membrane, said membrane being movable from an undistorted form (Figure 5A) to a distorted form (Figure 5B);
- at least one inlet (annotated) through which fluid is introduced into said pump

chamber;

- at least one outlet (annotated) through which fluid is removed from said pump chamber, said outlet being located at a spaced location from said inlet;
 - a bias pressure applicator (12a, 20a) adapted to pump a pressurized stream of said fluid into said pump chamber at a pressure sufficient to move the membrane from the undistorted form (figure 5A) to the distorted form (Figure 5B); Paragraph [0009] states: "The restoring elastic force of the first diaphragm may HELP PUSH the fluid through the port in the separating wall, and into the second pumping chamber", implying that even if the diaphragm 20b is not activated it will be distorted at least some amount because of the biasing action of diaphragm 20a "help push" the fluid on to diaphragm 20b. Note again that MPEP 2111.04 [R-3] states that the clause "adapted to" does not limit the scope of the claim to a particular structure and does not require steps in a method claim to be performed
 - with regards to the membrane comprising a thin shape memory alloy, Paragraph [0059] states: "Motion opposite of that effected by application of electrostatic forces may be augmented or effected by use of diaphragms 20a-d made of materials having SHAPE MEMORY characteristics", suggesting that the membrane can be a shape memory alloy
9. However, Cabuz et al does not disclose the working of a shape memory alloy that has a martensite-austenite transition temperature and the fluid being at a temperature that is below a martensite- austenite transition temperature and a heating system that heats said membrane to an actuation temperature that is above said

martensite-austenite transition temperature when said membrane is in said distorted form.

10. Nevertheless, Knebel et al discloses:

- a membrane (SMA) comprising a thin film shape memory alloy (14) that has a martensite-austenite transition temperature (Paragraph [0017]: "...the SMA element is at or below a first characteristic temperature, referred to as the martensite finish temperature (T_{mf}). When heated to a second characteristic temperature, referred to as the austenite start temperature (T_{as}) by electric resistance heating, the SMA element 14 begins a crystalline phase change which is completed when SMA element 14 reaches a third characteristic temperature, referred to as the austenite finish temperature (T_{af})")
- the fluid introduced into said pump chamber at a temperature that is below said martensite-austenite transition temperature (Paragraph [0018] states: "In this manner, SMA element 14 is cooled more effectively and the response time to return SMA element 14 to its ambient temperature martensite finish phase is reduced", the temperature of the fluid introduced via (28) into the chamber would have to be lower than the transition temperature to cool the SMA)
- a heating system that heats said membrane to an actuation temperature that is above said martensite-austenite transition temperature when said membrane is in said distorted form (Paragraph [0017] states: "When heated to a second characteristic temperature, referred to as the austenite start temperature (T_{as}) by electric resistance heating, the SMA element 14 begins a crystalline phase change which is completed

when SMA element 14 reaches a third characteristic temperature, referred to as the austenite finish temperature (T_{af}). During this phase change, the SMA element shrinks in length to assume a generally horizontal flat shape.."); "horizontal flat shape" implies that the SMA is returned to its undistorted form

11. It would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the diaphragm of Cabuz et al so to it is a shape memory alloy (SMA) and to include a heating element that actuates the SMA as taught by Knebel et al for the purpose of enhancing (augmenting) the motion opposite of that effected by application of electrostatic forces as suggested by Cabuz et al in Paragraph [0059].

12. Alternatively, Claim 25 and Claims 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cabuz et al (PG Pub US 20030068231 A1) in view of Knebel et al (PG Pub US 20020130284 A1) and as extrinsically evident from Knebel2 et al (US Patent 5,984,258 A)

13. Cabuz et al and Knebel et al as applied to Claims 1 and 14 disclose all the claimed limitations except for the mechanism of cooling by forced convection however, this is inherent to the increased velocity flow directed to the SMA element of Knebel et al as extrinsically evident from Knebel2 et al in Column 3, Lines 44-58.

14. In Re claims 2, 15 and 26, Cabuz et al discloses two outlet locations (47) and (48) that are located at the membrane seat surface.
15. In Re claims 3, 4 and 16, Cabuz et al discloses outlet (47) is located between the perimeter of the membrane (20b) and center (45a).
16. In Re claims 27 and 28, Cabuz et al as applied to claims 16 and 26 disclose all the claimed limitations.
17. In Re claim 5, Figure 3 of Cabuz et al discloses an elliptical perimeter for the membrane seat surface however, a circle is an embodiment of an ellipse with the major and minor axes being of equal length.
18. In Re claim 11 and 24, Knebel et al discloses in Paragraph [0018]: "Fast heating of SMA element 14 readily can be effected by passing a large CURRENT through it".
19. In Re claim 29, Cabuz et al discloses an additional actuation chamber (12c).
20. In Re claim 31 and 33, when the membrane of Cabuz et al is heated (SMA) per teachings of Knebel et al, for augmenting the return of the diaphragm (20b) to the seat, it applies force against the bias of the fluid above it that would have to be greater than

the bias of (20a) because the bias of (20a) and (20b) are equal and the heating of the SMA is what provides the extra force to the diaphragm.

21. In Re claim 6 and 19, Cabuz et al discloses in Paragraph [0031] that the membrane seat surface can be "curved shapes" instead of flat, Suggesting a dome shape extending inwardly into the actuation chamber (Prior art of record: Sterling discloses a dome shape – see Conclusions section).

22. In Re claims 7 and 8, Cabuz et al as applied to Claims 6 and 3 disclose all the claimed limitations.

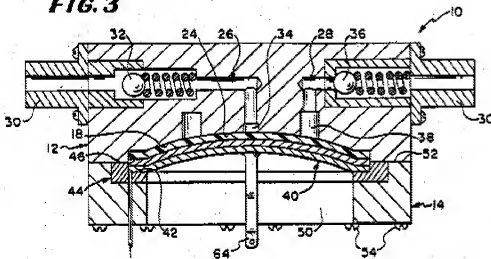
23. In Re claim 9, Cabuz et al as applied to Claims 6 and 2 disclose all the claimed limitations.

24. In Re claim 10, Cabuz et al discloses that the outlet (42b, 47) is located at substantially the same position on the perimeter of the seat surface (14b) as the outlet (42c, 48) is located on the perimeter of the seat surface (14c), thereby being equidistantly spaced around the perimeter.

25. In Re Claim 22, Cabuz et al as applied to claim 14, 3 and 9 discloses all the claimed limitations.

26. Claims 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cabuz et al (PG Pub US 20030068231 A1) and in view of Knebel et al (PG Pub US 20020130284 A1) and further in view of Brown (US Patent 4,636,149 A)

FIG. 3



27. In Re claim 12 and 13, Cabuz et al and Knebel et al as applied to Claim 1 disclose all the claimed limitations except for an inlet flow control check valve and an outlet pressure check valve.

28. Nevertheless, with reference to Figure 3 depicted above, Brown discloses an actuator body (10) with an actuator chamber (50) and pump chamber between deformable diaphragm/membrane (40) and seat (18), the diaphragm/membrane (40) comprising a bi-metallic element (58) and gasket (60), inlet (34), outlet (38), inlet flow control check valve (32) and outlet pressure check valve (36) and heating elements (Column 5, Lines 35-38).

29. It would have been obvious to a person having ordinary skill in the art at the time of the invention to incorporate an inlet flow control check valve as taught by Brown at

the inlet (42a, 70) of the pump of Cabuz et al, and to incorporate an outlet pressure check valve as taught by Brown at the outlet (42c, 48, 74) of the pump of Cabuz et al for the purpose of directional control of fluid flow in response to diaphragm movement (as stated in the Abstract of Brown)

30. Note that Brown discloses an annular ring discharge outlet (38) on the membrane seat surface located between the center and perimeter which can be interpreted as a plurality of outlets (at least 2) that are equidistantly spaced around the perimeter.

Response to Arguments

31. Applicant has argued that cooling is used to move the SMA of Knebel to its distorted form and that Knebel does not require that pressurized fluid distort the SMA.

32. Examiner's Response: The examiner agrees that Knebel does not REQUIRE that the pressurized fluid move the SMA to its distorted form however, the claim (1) language does not require that the pressurized fluid move the SMA either. The claim only states that the bias pressure applicator is ADAPTED TO pump fluid at sufficient pressure to distort the diaphragm. As discussed earlier, MPEP 2111.04 [R-3] states that the clause "adapted to" does not limit the scope of the claim to a particular structure and does not require steps in a method claim to be performed.

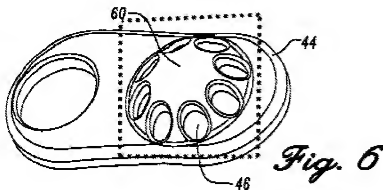
33. Applicant has also argued that fuel does not flow into the pump chamber as defined but rather into the chamber on the opposite side of the SMA of Knebel.

34. Examiner's response: If the fuel does not flow into the chamber as defined, how would it be able to exit from the metering outlet (32)? It is apparent from Figure 6 that the arrows depict the inlet of the fuel at (34) AND (38). The fuel would have to enter the defined pump chamber in order to exit through (32). Note that this reference is now being used as extrinsic evidence in Claim 25.

35. Applicant's arguments have been carefully considered but are not persuasive for the reasons above. The examiner therefore respectfully disagrees with the applicant.

Conclusion

36. The following prior art is made of record and not relied upon is considered pertinent to applicant's disclosure: Sterling (US Patent 6,668,971 B2) discloses an end cap in Figure 6 depicted below, with a plurality of outlets located between the perimeter and the center.



37. The addition of the phrase "pressurized stream" to amended Claim 1 has introduced a limitation into the claim that was not originally present in Claims 1 and 30, thereby changing the scope of the claim. The scope of claims 14 and 25 has also changed due to amendments. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DNYANESH KASTURE whose telephone number is (571)270-3928. The examiner can normally be reached on Mon-Fri, 9:00 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Devon Kramer can be reached on (571) 272 - 7118. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Devon C Kramer/
Supervisory Patent Examiner, Art
Unit 3746

DGK